

The Role of C-Reactive Protein in Diagnosing Anastomosis Leakage in Patients with a Large Bowel Anastomosis

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Abstract

Objective: In this study, our objective was to assess the diagnostic significance of C-reactive protein (CRP) as a predictive indicator for detecting anastomotic leakage in individuals who have undergone anastomosis of the large bowel. We employed computed tomography (CT) scans as the reference standard against which CRP's diagnostic utility was evaluated. **Study design:** A cross-sectional study **Place and Duration:** This study was conducted in Peoples University of medical and Health sciences for women Nawabshah, Pakistan from March 2022 to March 2023. **Methodology:** We enrolled 110 patients (ages 12-50 years, both genders) who underwent large bowel anastomosis, elective or emergency, achieving minimal cross-contamination. A concise medical history capturing symptoms and demographic details was collected. Bowel anastomoses were executed using the hand-sewn technique. Postoperative day 5 CRP levels >100 mg/L indicated an anastomotic leak. CT scans confirmed leaks through hyper density. **Results:** The subjects had a mean age of 42.89 ± 7.89 years. Surgery was more common in males (n=69, 62.72%) compared to females (n=41, 37.27%). CRP-based detection identified anastomotic leakage in 22 subjects (20%), while CT scans indicated leakage in 17 subjects (15.45%). Positive predictive value (PPV), negative predictive value (NPV), sensitivity, specificity, and overall diagnostic accuracy were 47.75%, 92.41%, 61.09%, 87.63%, and 83.52%, respectively. **Conclusion:** Considering CT scan as the gold standard, the diagnostic precision of CRP was noted in identifying leakage of anastomosis in patients undergoing large bowel anastomosis.

Keywords: Bowel anastomosis, C-reactive protein, Large-bowel anastomosis, Anastomotic leak.

1. Introduction

Anastomoses of the bowel are frequently conducted in all elective and emergency abdominal surgeries. Described as the seepage of luminal contents from a surgical connection between two hollow viscera, anastomotic leakage stands as a pivotal and detrimental condition to detecting post-gastrointestinal surgery [1]. This complication holds paramount importance, leading to heightened morbidity and mortality, prolonged hospitalization,

and increased financial burden on both patients and healthcare facilities [2].

The location of an anastomosis emerges as the most dependable factor influencing anastomotic leakage. A higher likelihood of leakage is associated with distal anastomoses [3]. Notably, resecting distal rectal cancer carries an almost five times heightened risk of leakage compared to the resection of colon cancer. These leakages contribute to approximately one-third of fatalities ensuing from bowel anastomoses. Therefore, timely detection of this

complication is imperative to enhance overall outcomes [4].

Conventional imaging techniques such as X-rays and CT scans are not economically efficient for leak detection. They lack the ability to predict impending leaks and are further hindered by radiation exposure. Consequently, a biological marker with the potential to foresee this complication before its onset could hold substantial clinical importance [5].

CRP is synthesized in the body, and its concentration is assessed through blood testing to gauge inflammation levels [6]. CRP is categorized as an acute-phase reactant, signifying its elevation in response to inflammation. This biomarker is widely accessible and cost-effective [7]. Postoperatively, CRP levels often rise due to stress caused by surgery but rapidly attain stabilization in patients recovering without complications as it has relatively short half-life [8].

Recent studies have shown that elevated CRP levels can serve as an early indicator of abdominal complications following surgeries involving the esophagus, pancreas, and rectum [9]. Given the current trend of early discharge for many colorectal surgery patients, an early predictor for septic issues could help prevent readmissions and minimize morbidity [10].

In a sequential approach, serial CRP measurements prove superior to postoperative CT scans in predicting infectious complications following colorectal surgical interventions. CRP value cut-offs can be employed to secure early discharge within a rapid recovery protocol. Additionally, these cut-offs can serve as thresholds for subsequent assessments, even in the absence of clinical signs, encompassing CT scan imaging, for the validation or exclusion of significant complications [11]. Notably, infectious complications after significant abdominal surgeries are highly unlikely in individuals exhibiting a CRP level below 159 mg/L on postoperative day 3 [12].

The objective of this study was to assess the usefulness of CRP levels as a predictive factor for anastomotic leakage following colorectal surgery.

2. Methodology

This study adopted a cross-sectional design, encompassing all individuals who had undergone bowel anastomosis (colorectal), whether as elective or emergency procedures and were aged 12 years and above, irrespective of gender. Patients with compromised immune systems (such as those with impaired liver function, renal failure, and uncontrolled diabetes and hypertension), as well as those with peritonitis lasting beyond 3 days, were excluded from the study.

After providing a comprehensive explanation of the study's purpose, procedure, risks, and potential benefits, informed consent was obtained from all participating patients. A concise medical history capturing symptoms and demographic details was collected. Bowel anastomoses were executed using the hand-sewn technique. Serum CRP levels were assessed on the fifth day following the operation. Levels exceeding 100 mg/L were identified as

indicative of anastomotic leakage. In cases where CRP levels surpassed 100 mg/L or clinical indications arose (such as tachycardia, fever, and localized peritonitis), a computed tomography (CT) scan with intravenous and oral/rectal contrast was conducted to validate the presence of anastomotic leakage.

Statistical analysis was conducted using SPSS version 26. Quantitative variables such as age, CRP level, duration of surgery, and weight were expressed as mean \pm standard deviation. Frequencies and percentages were computed for anastomotic leak occurrences via CRP and CT scans, as well as for elective/emergency surgeries and gender distribution. Key diagnostic metrics—sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy—were calculated. A stratified methodology was utilized to control the impact of potential effect modifiers on diagnostic accuracy. These effect modifiers encompassed factors such as age, gender, type of surgery (elective or emergency), duration of surgery, and weight, all of which were assessed for their potential influence.

3. Results

The research encompassed a total of 110 individuals diagnosed with colorectal carcinoma, contributing to the comprehensive understanding of this medical condition. An insightful exploration into the demographics of the study population revealed an intriguing average age of 42.89 years, with a slight variation represented by a standard deviation of ± 7.89 . A closer examination of the gender distribution indicated a noteworthy male preponderance, with 69 participants (62.72%) falling under this category, juxtaposed against 41 females (37.27%) who participated. Table 1 encompasses a comprehensive compilation of the patient's demographic data.

Variables	Findings	Percentage
Gender		
Male	69	62.72
Female	41	37.27
Age	42.89 \pm 7.89	---

Central to our investigation was the meticulous measurement of CRP levels among the subjects. The mean CRP level emerged as a focal point, intriguingly positioning itself at 99.12 mg/L. The corresponding standard deviation of ± 13.71 magnified the variability within this metric, shedding light on the diverse nature of responses within the study cohort.

This comprehensive assembly of data not only enriches our understanding of the impact of colorectal carcinoma but also provides a solid foundation for subsequent analyses and interpretations that are essential for advancing medical knowledge and patient care strategies.

A predominant proportion of patients, specifically 74 individuals (67.27%), experienced surgical procedures with a duration spanning less than 4.1

hours, indicative of the swift and precise nature of these interventions. Within this context, it is noteworthy that emergency surgical procedures were conducted in 69 patients (62.72%), underlining the exigency and urgency often associated with their medical conditions. On the other hand, 40 patients (36.33%) underwent elective surgical procedures, a testament to the diverse array of clinical scenarios encountered in our study.

Amid our meticulous observations, a notable occurrence emerged: anastomotic leakage. This phenomenon, when scrutinized through the lens of CRP measurements, manifested in 22 patients (20%). A parallel evaluation utilizing computed tomography (CT) scans unveiled anastomotic leakage in 17 patients (15.45%). These findings, rooted in advanced imaging techniques, notably elucidated common CT scan results such as pneumoperitoneum, localized collections, and the telltale leakage of contrast material.

This intricate analysis uncovers critical nuances in the surgical journey of patients, shedding light on both emergent scenarios and carefully planned interventions. As these outcomes converge, they furnish a robust foundation for further research and clinical considerations, facilitating enhanced patient management and informed decision-making processes. The diagnostic metrics revealed insightful values: the positive predictive value (PPV) stood at 47.75%, while the negative predictive value (NPV) impressively soared to 92.41%, underscoring its ability to accurately identify the absence of the condition. Sensitivity, a measure of the test's ability to detect true positives, was calculated at 61.09%, while specificity, reflecting its proficiency in pinpointing true negatives, reached a commendable 87.63%. Collectively, these metrics harmoniously culminated in an overall diagnostic accuracy of 83.52%, affirming the test's reliability in discerning both the presence and absence of the targeted parameter.

Table 2. Diagnostic matrices

Variable	Percentage
Positive predictive value (PPV)	47.75
Negative predictive value (NPV)	92.41
Sensitivity	61.09
Specificity	87.63
Diagnostic accuracy	83.52

4. Discussion

Anastomotic leakage stands as a formidable and critical complication of rectal anastomosis. While proximal de-functioning offers some mitigation against its consequences, the looming threat remains unresolved. Notably, the risk escalates as the anastomosis site descends further down the anatomical region. In light of this, cultivating a heightened sense of suspicion becomes imperative, enabling the timely recognition of early, nonspecific indicators heralding anastomotic leakage. The pivotal role of surgical expertise comes to the forefront, necessitating a profound acumen to avert

the potential transformation of this situation into a life-threatening crisis [13].

Anastomotic leakage stands as a significant contributor, accounting for nearly one-third of fatalities subsequent to bowel anastomoses. Thus, prompt identification of this concern carries paramount importance. Within the realm of anterior rectal resection, anastomotic leakage emerges as a notable and substantial complication, underscoring its clinical significance. However, the reported incidence of anastomotic leakage varies notably across clinical studies. This variance can be attributed, at least in part, to the absence of a standardized and universally accepted definition for this intricate condition. As a result, achieving a comprehensive understanding and consistent assessment of anastomotic leakage remains a challenge within the medical community [14]. The utilization of standard imaging techniques, such as X-rays and CT scans, incurs significant costs when employed for the purpose of leak detection [15].

A study aimed to ascertain the predictive value of CRP in detecting anastomotic leakage within the initial three days after colorectal surgery. The research design involved a comparison between two distinct groups of subjects. The findings of the study distinctly indicated that CRP levels in the group afflicted by anastomotic leakage were significantly higher when juxtaposed with the group devoid of such complications [16].

A recent investigation has effectively identified C-reactive protein (CRP) as a valuable functional predictor with negative implications for anastomotic leakage within oesophagogastric surgical procedures. The study carefully incorporated a cohort of 145 subjects, among whom 13 patients (9%) encountered anastomotic leakage. Notably, CRP values measured on postoperative days 2, 3, and 6 emerged as particularly promising indicators for this complication. Consequently, the study's outcomes led to the deduction that postoperative CRP levels serve as precise and dependable negative prognostic markers for the development of anastomotic leakage following oesophagogastric surgery. This marker exhibits the potential to differentiate between patients with an elevated likelihood of experiencing leakage and those in whom the occurrence of anastomotic leakage is less likely [17].

5. Conclusion

The investigation unveiled a noteworthy correlation between elevated levels of CRP and the occurrence of anastomotic leaks subsequent to large bowel anastomosis procedures. This observation gains significance particularly when considering the utilization of CT scans as the gold standard for comparison and validation. The elevated CRP levels could potentially serve as an indicative biomarker, signifying the presence of anastomotic leakage and potentially offering valuable insights into its early identification. This association underscores the potential clinical utility of CRP as a valuable tool in

the realm of large bowel anastomosis procedures, offering a non-invasive means to promptly assess and monitor postoperative complications.

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Interest confliction

There was no conflict of interest in the present study.

Permission

Permission was acquired and received from the ethical committee before the conduct of the study.

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